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AN IMPROVED METHOD OF ARTIFICIAL POLLINATION IN CORN.

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## BUREAU OF PLANT INDUSTRY.

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## AN IMPROVED METHOD OF ARTIFICIAL POLLINATION IN CORN.<sup>1</sup>

### INTRODUCTION.

In the breeding of corn, if accurate records regarding parentage are to be kept, all pollinations must be done by hand. In the methods of study now popular many pollinations are self-pollinations; that is, it is necessary to place the pollen of a plant on the silks of the same plant and protect the silks from all other pollen. By the methods usually employed it is impossible to be certain that all foreign pollen is excluded. This uncertainty prevents the placing of confidence in the ancestry of plants that exhibit unexpected characters.

From what is known of reversions and mutations the appearance of characters assumed to be absent from the parents, though of rare occurrence, must still be considered. A technique so faulty that the evidence on this point can not be relied upon removes all hope of touching some of the most vital problems in heredity and renders all data regarding the absolute purity of the germ cells valueless. It is believed that the method here described makes it possible to place the same confidence in the self-pollination of corn as in plants which are not wind-pollinated.

### METHODS USUALLY EMPLOYED.

The usual method of making self-pollinations is to inclose the tassels and young ears in strong paper bags. When pollen has accumulated in the bag surrounding the tassel and the silks have emerged from the young ear, the bag containing the pollen is removed. The ear is then uncovered, the pollen dusted over the silks, and the bag replaced on the ear. During the operation the silks are necessarily exposed for a short time to any pollen that may be floating in the air. A number of refinements have been devised by different operators

<sup>1</sup>For the original suggestion of the method here described, the writers are indebted to Dr. L. J. Briggs, of the Bureau of Plant Industry.

to reduce the chances of the silks receiving foreign pollen. The most effective is that proposed by Roberts.<sup>1</sup> In his experimental field the tassels are all bagged before they begin shedding pollen; there is thus no pollen free in the air of the field, except the small quantity that escapes while making the hand pollinations. The quantity of free pollen is further reduced by an ingenious method of applying the pollen by means of an insect-powder "gun" or spring blower. By this method the pollen is distributed so perfectly that but a small part of the amount usually required is sufficient. Another precaution used by careful operators is to wash their hands in alcohol after each pollination in order to destroy the vitality of any pollen that might remain on the hands.

#### EXTENT OF CONTAMINATION.

Regarding the amount of foreign pollen that gains access to ears pollinated in the ordinary way, East states that in 53 ears bagged and the bags not removed 14 seeds developed and in 25 ears manipulated as in pollinating but to which no pollen was applied 20 seeds were formed.<sup>2</sup> These figures are not very different from results obtained by the writers in using the same method. When 106 ears were bagged and the bags allowed to remain, 10 seeds were produced on 5 ears. The operation of pollination applied to 23 ears, but without the application of pollen, produced in all 1 seed. Our somewhat more favorable results are probably the result of bagging the ears at an earlier date.

#### DESCRIPTION OF THE NEW METHOD.

The method here proposed involves the use of strong paper tubes about 4 inches in diameter and 40 inches long. Longer tubes are sometimes necessary for very tall plants, and for short plants a piece may need to be torn off. To apply the tubes, one end is pushed over the tassel and wired firmly at a point just below the upper end of the last leaf sheath. The other end of the tube is then brought down and passed over the young ear and securely wired. (Fig. 1.) In pulling the tube down to the ear the tassel will be bent to one side in such a way that as soon as the anthers open the pollen falls down the tube and comes in contact with the silks. To protect against any foreign pollen which may be present on the tassel or ear when bagged, the tubes should be put in place four or five days before the silks are expected to appear. The greatest difficulty in applying the tubes is

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<sup>1</sup> Roberts, H. F. A New Method of Corn Pollination. American Breeders' Magazine, vol. 2, no. 1, 1911, p. 55.

<sup>2</sup> East, E. M., and Hayes, H. K. Inheritance in Maize. Bulletin 167, Connecticut Agricultural Experiment Station, 1911, pp. 30-31.

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to allow for the elongation of the stalk above the ear. Unless guarded against, this elongation will break the stalk at the base of the tassel and then push through the paper, making an opening where foreign pollen can enter. To prevent this breaking of the tube, two extra



FIG. 1.—Corn plant, showing method of using paper tube to insure self-pollination.

foldings are taken where the paper is cemented, making a strip an inch or so wide composed of four thicknesses of paper. In adjusting the tubes this strip is placed on the upper side, causing the tube to form an even curve instead of bending sharply at one point.

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Since the tubes remain in place until all danger from foreign pollen is past, provision must be made for the increasing size of the ear. This can be done by using a coiled instead of a straight wire to fasten the tube to the ear. The coiled wires are easily made by wrapping the wire around any small cone-shaped object, like the point of a lead pencil. The advantage of the cone-shaped coil over a cylindrical coil is that the tension necessary to straighten the coil is nicely graduated when a cone-shaped coil is used. (Fig. 2.)

Some experience is necessary to apply the tubes properly, and the exact manner has to be varied slightly for the different types of corn. When the ears are well exerted before silking it has been found best to bring the leaf just below the ear up against the outside of

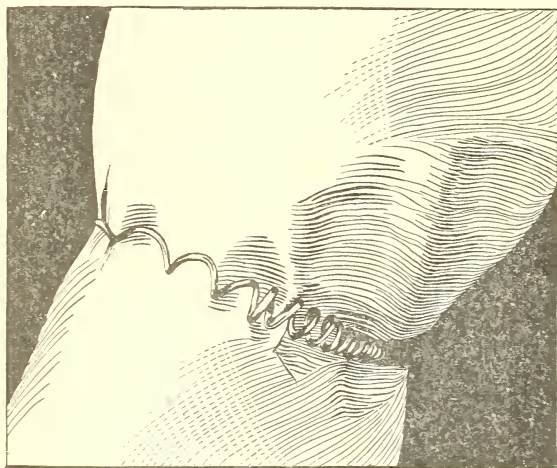


FIG. 2.—Coiled wire used in attaching the paper to the ear.

the tube and pass the wire around it: otherwise, it is difficult to keep the tube from slipping off the ear as the stalk elongates. The most difficult cases are those where the exertion of the ear at silking is small. In such cases it is necessary to pass the wire around the stalk as well as around the leaf. With varieties that have large

husk leaves it is well to remove them by cutting off the tips of the husks at a point beyond the tip of the young ear: otherwise, the silks become entangled in the mass of leaves and the pollen fails to gain access to all.

While this method can be generally applied only to ears that are to be self-pollinated, it works equally well for artificially crossing two plants that are adjacent in the same or neighboring rows. In testing Mendelian ratios it will be found convenient to arrange the planting with the hybrids between the parents. It will thus be possible to apply the method to self-pollinations and crosses between the hybrid and the parents.

Where the tubes are used it would seem that the only possible source of contamination would be from pollen on the tip of the ear or husk leaves at the time the tube was applied. To test this possi-

bility, the tassels were removed from four plants and tubes applied in the customary way. Before applying the tube a quantity of fresh pollen was placed on the tip of the ear. No seed was formed on any of these ears, the time that had elapsed before the silks emerged having been sufficient for the pollen to lose its vitality.

In work with bagged plants the writers have been greatly annoyed by the frequency with which the ear grows through the bag during moist weather. This annoyance is entirely avoided by the use of tubes. A further source of error when bags are used, unless the wiring is carefully done, is the possibility of the silks becoming exposed by growing down along the husks and coming out between the wire and the ear. When tubes are used, the small diameter of the tubes and the fact that the elongation of the ear is unobstructed causes the silks to grow straight up the tube.

Regarding the time necessary to apply the tubes, it was found that with practice 30 tubes could be applied in an hour. Since all the work is completed in the one operation, the saving of time as compared with the system of bagging is very considerable.

Approved:

JAMES WILSON,  
*Secretary of Agriculture.*

WASHINGTON, D. C., November 10, 1911.

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